APPENDIX

Changes to Specification:

The following is a marked-up version of the amended paragraphs:

[0008] FIG. 1 is a figure of a brake system which shows the brake device according to one embodiment of this invention.

FIG. 1A is an enlarged view of the master cylinder and booster of FIG. 1.

FIG. 2 is an explanatory figure which shows the pressure control valve contained in the above brake device.

FIG. 3 is a block diagram of the fluid pressure control device of the above brake device.

FIG. 4 shows the relation between the master pressure controlled by the fluid pressure control device contained in the above brake device, and the assistance power (the target pressure difference).

FIG. 5 is a flow chart which shows the multi-mode failure detection routine that is stored in the ROM of the above fluid pressure control device.

FIG. 6 is a figure which shows the relations between the brake operating power and the master pressure in the above brake device.

FIG. 7 is a flow chart which shows the failure related brake pressure control routine that is stored in the ROM of the above fluid pressure control device.

FIG. 8 is a flow chart which shows the normal brake pressure control routine stored in the ROM of the above fluid pressure control device.

FIG. 9 shows the relation between the operation power and the master pressure of the brake pedal in the above brake device.

FIG. 10 shows the operation power and the condition of the change in the master pressure when large amount of fluid leakage failure is detected in the above brake device, respectively.

FIG. 11 shows the operation power and the condition of the change in the master pressure when a small amount fluid leak failure is detected in the above brake device, respectively.

FIG. 12 shows the operation power and the stroke, the booster pressure and the condition of the change in each fluid pressure of two pressure chambers of the master cylinder when the bottoming condition occurred in the above brake device, respectively.

FIG. 13 shows the master pressure and the changing condition of the operation power in the above brake device when the servo function failure occurred during the brake operation.

FIG. 14 is a flow chart which shows the multi-mode failure detection routine that is stored in the ROM of the fluid pressure control device contained in the brake device in another embodiment of this invention.

[0010] A brake pedal 10, which functions as a brake operating member, is connected to a master cylinder 14 through a vacuum booster (hereafter abbreviated to "booster") 12 in FIG. 1. The master cylinder 14 is of the tandem type, in which two pressure pistons 14a and 14b engaged with each other in series can slide, and two pressure chambers 14c and 14d are formed by each other independently in the housing in the front of each pressure piston. The master cylinder 14 generates an equal fluid pressure in each of the pressure chambers mechanically, corresponding to the brake operating power which is the pedal power of the brake pedal 10. The brake device in this embodiment is a two system-type brake.

[0011] The detailed explanation of the booster 12 is omitted because it is a common device, which comprises a vacuum chamber 12a connected to a surge tank (the air intake side of the combustion chamber of the engine) and a pressure chamber 12b connected to the vacuum chamber 12a or to the atmosphere depending on the brake pedal 10 operation. This pressure difference does not increase any more after the pressure of the pressure chamber 12b increases to the atmospheric pressure even if the brake pedal 10 is operated further. The condition when the pressure of the pressure chamber 12b reaches the atmosphere, is the limitation point of the brake power assistance, and the fluid pressure of the master cylinder 14 when the booster 12 reaches the limitation point of the brake power assistance is the limitation pressure of the brake power assistance.

[0031] The brake power characteristic control means that the brake power characteristic which has the relation between the brake operating power ~~f~~ and the vehicle deceleration ~~G~~ is controlled so as to increase the vehicle deceleration ~~G~~ in the same proportion of the brake operating power ~~f~~ in spite of a decrease in the power of the booster 12. It can be referred to as the brake power assist control because it can assist the

brake power when the booster 12 reaches the limitation point of the brake. It also can be referred to as the servo power control, because the servo ratio is controlled.

[0045] In this embodiment, the first predetermined operation power F0 is decided based on, for example, the set load of the return spring 15a, 15b which is contained in the booster 12 and the master cylinder 14, etc. When the brake device is in the normal condition, the first predetermined fluid pressure Pth1 is made a smaller value than the master pressure at the time that the operation power is the first predetermined operation power F0. The normal condition includes the case that a small amount of fluid leakage is occurring.

[0046] When the booster 12 is in the normal condition, the brake operating power and the assistance power of the booster 12 are added to the output member 11 (see FIG 1A) in the booster 12, and the output of the output member 11 is added to the pressure piston 14b in the master cylinder 14. In the booster 12, if the brake operating power added to the input member 13 through the brake pedal 10 becomes larger than the power based on the set load of the return spring 15b of the input member 13, the input member is moved against the power of the return spring, the control valve is placed in the operating condition, and the power piston generates the assistance power. In the master cylinder 14, if the output power added to the pressure piston 14b becomes bigger than the power based on the set load of the return spring of the master cylinder 14, the pressure piston is moved against the power of the return spring 15b, and the fluid pressure is generated in the pressure chamber.

[0048] Clearly by the above explanation, when the booster 12 is in the normal condition, if the power added to the pressure piston (the brake operation power by the driver and assistance power by the booster 12) is beyond the set load of the return spring of the master cylinder 14 (F0', FIG. 9), the fluid pressure is generated in the pressure chamber, and in the case of the servo function failure, while the power (the brake operated power) added to the pressure piston is smaller than the set load of the return spring of the master cylinder 14, the fluid pressure is not generated in the pressure chamber. Therefore, if the value between these powers is determined to be the first predetermined operation power F0, and the first predetermined fluid pressure Pth1 is determined to be a smaller value from the master cylinder pressure in the brake device of the normal condition, failure of the booster 12 and a large amount of fluid leakage can be detected surely based on whether the detected master

pressure is greater than the first predetermined fluid pressure Pth1 or not. The first predetermined operation power ~~F1~~F0 and the first predetermined fluid pressure Pth1 can be referred to as the servo function failure judgment operation power and the servo function failure judgment fluid pressure, respectively.

[0051] The bottoming condition is the condition in which, in the master cylinder 14, (1) the front pressure piston 14a of the two pressure pistons is contacted to the stopper 19 of the master cylinder 14 (it also may be the bottom part of the master cylinder), (2) the rear pressure piston 14b is contacted to the front pressure piston 14a, or (3) both conditions (1) and (2) occur (the front pressure piston 14a is contacted to the master cylinder and the rear pressure piston 14b is contacted to the front piston 14a).

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[0055] As shown in (a) of FIG. 12, when the bottoming condition occurs (when either of ① -③ occurs), the operating power becomes large rapidly. The reaction power added to the pressure piston corresponding to the operating power becomes large, but if the master pressure becomes small rapidly because of the bottoming condition, it is common that the operation power is increased rapidly by the driver. Therefore, when the increasing gradient of the operation power is larger than the predetermined increasing gradient, the bottoming condition can be detected. In addition, the bottoming condition can be detected based on the changing condition of the increasing gradient of the operation power. For example, it can be detected based on whether the increasing gradient of the operation power is larger than the predetermined value, or whether the increasing rate of the increasing gradient is larger than the predetermined ratio.

[0056] As shown in (b) of FIG. 12, when the bottoming condition occurs, the operation gradient of the stroke becomes very small. The amount of the operating stroke of that situation is beyond the amount of the usual brake operation. Therefore, when the amount of the stroke is larger than the predetermined stroke S0 and the changing gradient of the stroke is very small, it can be determined that the bottoming condition has occurred. In addition, this occurrence of the bottoming condition can be detected distinguishably from the situation in which the driver keeps the operation stroke of the brake pedal 10 constant during the brake operation.

[0058] As shown in (c) of FIG. 12, when the bottoming condition occurs, the pressure of the vacuum chamber 12a of the booster 12 (the booster pressure) approaches the vacuum pressure changed from the approaching the atmospheric pressure even if the operation power added to the brake pedal is on the increasing state. The booster pressure is approached to the atmospheric pressure by the stroke operation of the operation of the brake pedal 10, if the operation stroke is kept at the constant, the booster pressure is approached to the vacuum pressure. In addition, the situation in which the operation stroke is kept at the constant is the situation that the brake operation power is released by the driver, and the bottoming condition can be detected distinguishably from the above situation based on the changing situation of the booster pressure while the brake operation power is increasing.

[0060] As shown in (d) of FIG. 12, in the brake system in which the fluid leakage is not occurring, when the bottoming condition occurs, the master pressure is increased rapidly based on the increasing of the brake operation power. As shown in (e), in the brake system which the fluid leakage is occurring, the master pressure is decreased rapidly. Therefore, if the decreasing gradient of the master pressure is larger than the predetermined decreasing gradient, the bottoming condition can be detected. Also, when the decreasing gradient of the master pressure is larger than the predetermined gradient in the bottoming condition and the amount of the fluid leakage is small, it is not always larger than the predetermined gradient when the amount of the fluid leak is large because, as shown in FIGS. 11 and 12, the master pressure is also very small before the bottoming condition when the amount of the fluid leakage is large.

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[0070] If the servo function failure is detected, the judgment of step ~~S53~~ S51 becomes YES, the brake fluid pressure is controlled by the first compressing device 150 in step S54 through step S56. The target pressure P* is set when the servo ratio is constant. It is set to the value of the booster 12 in the normal condition, or after the booster 12 reaches the limitation point of the brake power assistance, it is set to the value which is determined by the normal condition brake control, hereafter abbreviated to the target pressure of the normal condition. When the servo function failure occurs, the master pressure becomes a little small, but since the fluid leakage does not occur, the brake fluid pressure can be controlled to the same value of the target fluid pressure P*.

SUB D11

Changes to Claims:

Claims 2, 13 and 15 are canceled.

Claims 19-21 are added.

The following are marked-up versions of the amended claims:

1. (Amended) A brake device having a fluid pressure source ~~device~~ which generates a fluid pressure based on operation of a brake operating member, the brake device actuated by ~~the~~ fluid pressure generated by the fluid pressure source, comprising:

a brake operating amount detector which detects an operating amount of the brake operating member,

a fluid source pressure detector which detects the pressure generated in the fluid pressure source ~~device~~, and

a failure detector which detects and distinguishes between different types of failures ~~distinctively~~ of the brake device based on the pressure detected by the fluid source pressure detector and the operating amount ~~of the brake operation~~ detected by the brake operating amount detector, wherein the failure detector detects and distinguishes the types of the failures between: (i) a case in which the pressure detected by the fluid source pressure detector at a time when the detected operating amount is a first predetermined amount of operation which is smaller than a second predetermined amount of operation is smaller than a first predetermined pressure which is larger than a second predetermined pressure, (ii) a case in which the pressure detected by the fluid source pressure detector at the time when the detected operating amount is the first predetermined amount of operation is larger than the first predetermined pressure, and (iii) a case in which the pressure detected by the fluid source pressure detector at a time when the operating amount detected by the brake operation amount detector is the second predetermined amount of operation is larger than the second predetermined pressure.

3. (Amended) ~~A~~The brake device as in claim ~~2~~ 1, wherein the fluid pressure source ~~device~~ includes ~~①~~ a master cylinder which generates the fluid pressure corresponding to ~~the~~an input power, and ~~②~~ a booster which increases ~~the~~an operation power of the brake operating member and outputs an increased operation power to the master cylinder,

the fluid source pressure detector includes a master cylinder pressure detector which detects the pressure of the master cylinder or a connected portion of the master cylinder, and

the failure detector detects ~~the~~a failure of the booster if the pressure of the master cylinder at the time when the amount of the brake operation is the second predetermined amount of operation is larger than the second predetermined pressure, and detects the failure of ~~the~~ fluid leakage of the brake device if the pressure of the master cylinder at the time when the amount of the brake operation is the second predetermined amount of operation is smaller than the second predetermined pressure.

4. (Amended) ~~A~~The brake device as in claim 3, wherein the failure detector includes a bottoming detector which detects a bottoming condition in the master cylinder.

5. (Amended) ~~A~~The brake device as in claim 4, wherein the brake operating amount detector includes an operation power detector which detects ~~the~~ power supplied to the brake operating member, and

the bottoming detector detects the bottoming condition based on whether an increasing gradient of the ~~operation~~ power detected by the brake operating amount detector is larger than ~~the~~a predetermined gradient or not.

6. (Amended) ~~A~~The brake device as in claim 5, further comprising a brake fluid control device which controls ~~the~~a brake fluid pressure in ~~a~~ different ways based on the type of the failure detected by the failure detector,

the fluid source pressure detector includes a master cylinder pressure detector which detects ~~the~~a master pressure of the master cylinder or a connected portion of the master cylinder,

the failure detector detects a small amount fluid leakage failure if the master pressure detected by the master cylinder pressure detector at the time when the brake operation detected by the brake operating amount detector is the first predetermined operation is larger than the first predetermined pressure, and a decreasing gradient of the master pressure detected ~~b~~y the master cylinder pressure detector is larger than ~~the~~a predetermined gradient,

the brake fluid control device includes a leak amount control device which increases ~~the~~a supplying amount of ~~the~~a brake fluid to ~~the~~a brake, if the failure detector detects the small amount fluid leakage failure, ~~from a~~compared to the supplying amount of the brake fluid when ~~the~~a large amount fluid leakage failure is detected.

7. (Amended) ~~A~~The brake device as in claim 5, wherein:

~~-~~the ~~fluid pressure source device is a~~ master cylinder ~~which~~ has two pressure chambers and generates the fluid pressure corresponding to the input power,

~~and~~the brake device includes a front side brake connected to one of the two pressure chambers and a rear side brake connected to the other of the two pressure chambers, and

the fluid source pressure detector includes a front wheel side pressure detector which detects the fluid pressure of the pressure chamber which is connected to the front ~~wheel~~ side brake or a portion connected to ~~the~~a corresponding pressure chamber of the master cylinder.

8. (Amended) ~~A~~The brake device as in claim ~~7~~ 1, further comprising a brake fluid control device which controls ~~the~~a brake fluid pressure in ~~a~~ different ways based on the type of the failure detected by the failure detector,

the fluid pressure source ~~device~~ includes a master cylinder which has a pressure chamber and generates the fluid pressure corresponding to ~~the~~an input power, a first compressing device which compresses an operating fluid of the pressure chamber of the master cylinder and supplies a compressed operating fluid to ~~the~~a brake, a second compressing device which compresses the operating fluid stored in an atmospheric condition in a reservoir tank ~~which~~, the reservoir tank is larger than the pressure chamber of the master cylinder, and

the brake fluid control device includes a brake condition selection device which selects either of a first condition in which the brake is compressed by the first compressing device, or a second condition in which the brake is compressed by the second compressing device based on the type of the failure detected by the failure detector.

9. (Amended) A brake device having a fluid pressure source ~~device~~ which generates a fluid pressure based on operation of a brake operating member, the brake device actuated by the fluid pressure generated by the fluid pressure source, comprising:

a brake operating amount detector which detects an operating amount of the brake operating member,

a fluid source pressure detector which detects the fluid pressure generated in the fluid pressure source ~~device~~,

a failure detector which detects and distinguishes between different types of failures ~~distinctively~~ of the brake device based on the pressure detected by the fluid source pressure detector and the operating amount ~~of the brake operation~~ detected by the brake operating amount detector, and

a brake fluid control device which controls the brake fluid pressure in ~~a~~ different ways based on the type of the failure detected by the failure detector, wherein the fluid pressure source includes a master cylinder which has a pressure chamber and generates the fluid pressure corresponding to an input power, a first compressing device which compresses an operating fluid of the pressure chamber of the master cylinder and supplies a compressed operating fluid to a brake, a second compressing device which compresses the operating fluid stored in an atmospheric condition in a reservoir tank, the reservoir tank is larger than the pressure chamber of the master cylinder, and

the brake fluid control device includes a brake condition selection device which selects either of a first condition in which the brake is compressed by the first compressing device, or a second condition in which the brake is compressed by the second compressing device based on the type of the failure detected by the failure detector.

10. (Amended) ~~A~~The brake device as in claim 9, wherein the ~~fluid pressure source device includes a master cylinder which generates the fluid pressure corresponding to the input power, and~~

~~the~~ failure detector includes a bottoming detector which detects a bottoming condition in the master cylinder.

11. (Amended) ~~A~~ The brake device as in claim 10, wherein the brake operating amount detector includes an operation power detector which detects a power supplied to the brake operating member, and

the bottoming detector detects the bottoming condition based on whether an increasing gradient of the operation power detected by the brake operating amount detector is larger than ~~the~~a predetermined gradient or not.

12. (Amended) ~~A~~The brake device as in claim 10, wherein the fluid source pressure detector includes a master cylinder pressure detector which detects ~~a~~the pressure of a pressure chamber of the master cylinder or a connected portion of the master cylinder,

the failure detector detects a small amount fluid leakage failure if the master pressure detected by the master cylinder pressure detector at the time when the brake operation detected by the brake operating amount detector is a first predetermined operation is larger than a first predetermined pressure, and a decreasing gradient of the master pressure detected by the master cylinder pressure detector is larger than ~~the~~a predetermined gradient, and

the brake fluid control device includes a leakage amount control device which increases a supplying amount of a brake fluid to ~~the~~a brake if the failure detector detects a small amount fluid leakage failure, ~~from a~~compared to the supplying amount of the brake fluid when a large amount fluid leakage failure is detected.

14. (Amended) ~~A~~The brake device as in claim 9, wherein:

_____-the ~~fluid pressure source device is a~~ master cylinder ~~which~~ has two pressure chambers and generates the fluid pressure corresponding to the input power, ~~and~~

_____-the brake device includes ~~the~~a front side brake connected to one of the two pressure chambers and a rear side brake connected to the other of the two pressure chambers, and

the fluid source pressure detector includes a front wheel side pressure detector which detects the fluid pressure of the pressure chamber which is connected to the front ~~wheel~~ side brake or a portion connected to ~~the~~a corresponding pressure chamber of the master cylinder.

16. (Amended) A brake device having a fluid pressure source ~~device~~ which generates a fluid pressure based on operation of a brake operating member, the brake device actuated by the fluid pressure generated by the fluid pressure source, comprising:

a brake operating amount detector which detects an operating amount of the brake operating member,

a fluid source pressure detector which detects the pressure generated in the fluid pressure source ~~device~~,

a failure detector which detects and distinguishes between different types of failures ~~distinctively~~ of the brake device based on the pressure detected by the fluid source pressure detector and the operating amount ~~of the brake operation~~ detected by the brake operating amount detector,

the fluid pressure source device includes a master cylinder which generates the fluid pressure corresponding to an input power, and

the failure detector includes a bottoming detector which detects a bottoming condition in the master cylinder based on whether an increasing gradient of the brake operating amount detected by the brake operating amount detector is larger than a predetermined gradient.

17. (Amended) ~~A~~The brake device as in claim 16, wherein the brake operating amount detector includes an operation power detector which detects ~~a~~an operation power supplied to the brake operating member, and

the bottoming detector detects the bottoming condition based on whether an increasing gradient of the operation power detected by the brake operating amount detector is larger than a predetermined gradient or not.

18. (Amended) ~~A~~The brake device as in claim 16, wherein the master cylinder has two pressure chambers and generates the fluid pressure corresponding to the input power,

and the brake device includes a front side brake connected to one of the two pressure chambers and a rear side brake connected to the other of the two pressure chambers, and

the fluid source pressure detector includes a front wheel side pressure detector which detects the fluid pressure of the pressure chamber which is connected to the front wheel side brake or a portion connected to ~~the~~a corresponding pressure chamber of the master cylinder.